Macallen Dam Feasibility and Impact Analysis

Public Meeting

Draft Feasibility Study Results

Lamprey River, Newmarket, NH

Presented By:

Gary Lemay, PE

Mark Wamser, PE

Gomez and Sullivan Engineers

June 23, 2014

GOMEZ AND SULLIVAN Engineers, P.C.

Meeting Logistics

- Please hold questions until after presentation.
- Limit Q&A to 5 minutes per speaker. May be allowed another 5-minutes pending number of speakers.
- Technical questions- please provide technical questions in writing (written comment due dates discussed at end of presentation).

Meeting Agenda

- Scope of Feasibility Study
- Draft Feasibility Study Overview
  - Sediment due diligence and thickness probing
  - Environmental Information
  - Infrastructure Information
  - Hydrologic Analysis
  - Hydraulic Modeling Results
  - Cultural Resources
  - Other Potential Alternatives
  - Budgetary Estimates
- Remaining Study Schedule
- Q&A

Scope of Feasibility Study

- Original scope of feasibility study included evaluating resource impacts under dam removal conditions. Resources included infrastructure, flooding, sediment, recreation, environmental resources, cultural resources and aesthetics.

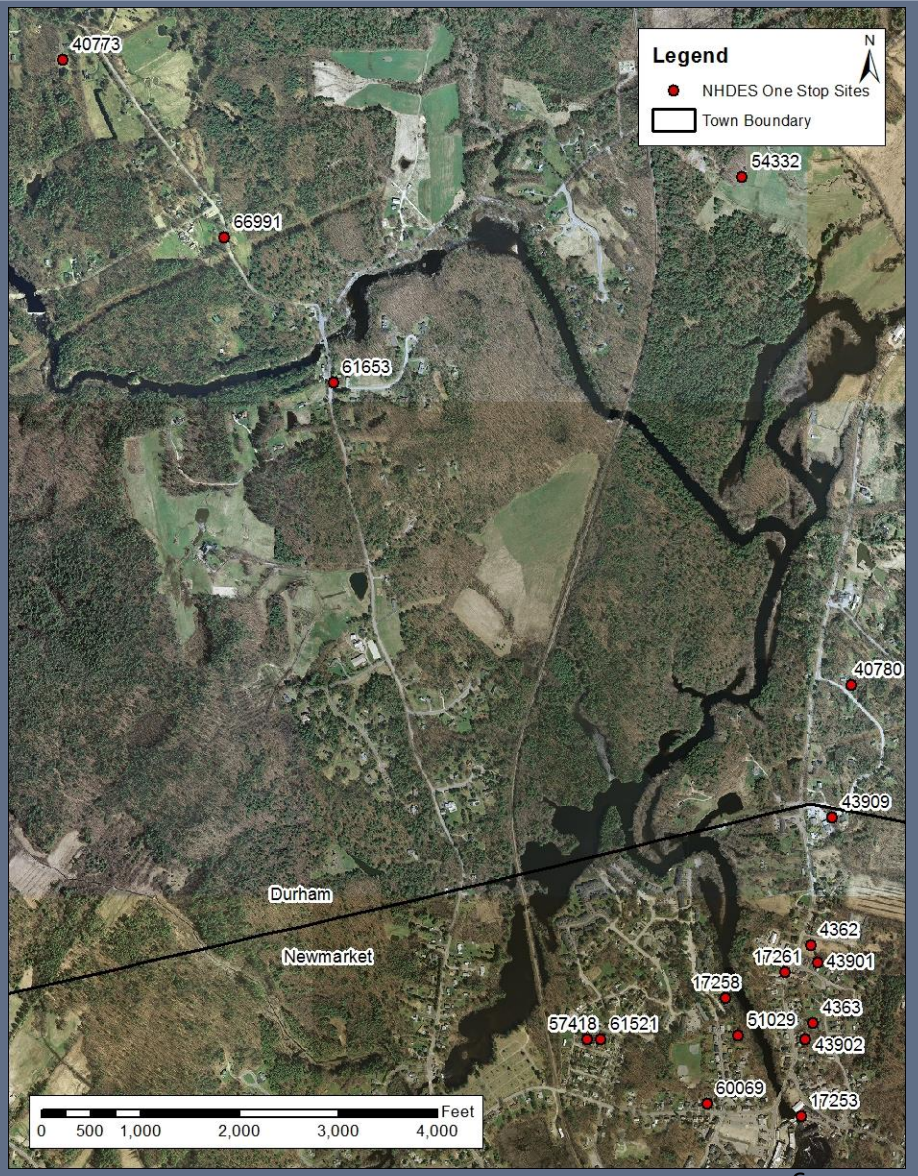
- Due to funding limitations not all resource impacts were evaluated under dam removal conditions. Some resources were evaluated in full, partially, or not at all.

- Should the town opt to advance the dam removal alternative, additional studies are needed to determine the full impact of dam removal on all resources. Budgetary estimates to conduct the additional resource impact studies are included at end of presentation.

Draft Feasibility Study Overview

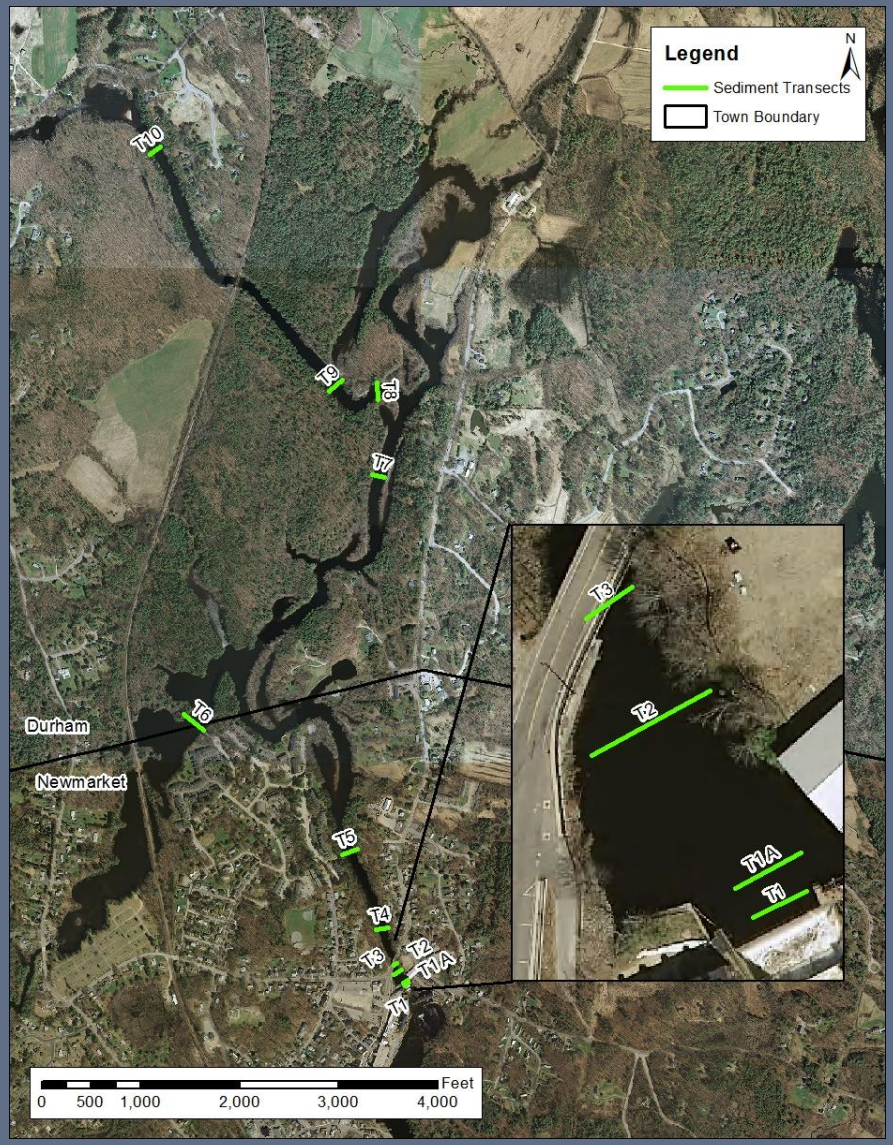
Sediment Due Diligence

- A map of NHDES One-Stop listed sites near the Macallen Dam impoundment was developed.
- One EPA Superfund site in Epping, within Piscassic watershed, approximately 7 miles upstream of the impoundment extent.
- In summary, petroleum and gas spills have occurred near the impoundment in the past. We recommend the standard suite of contaminant testing, plus any chemicals potentially associated with the Superfund site.



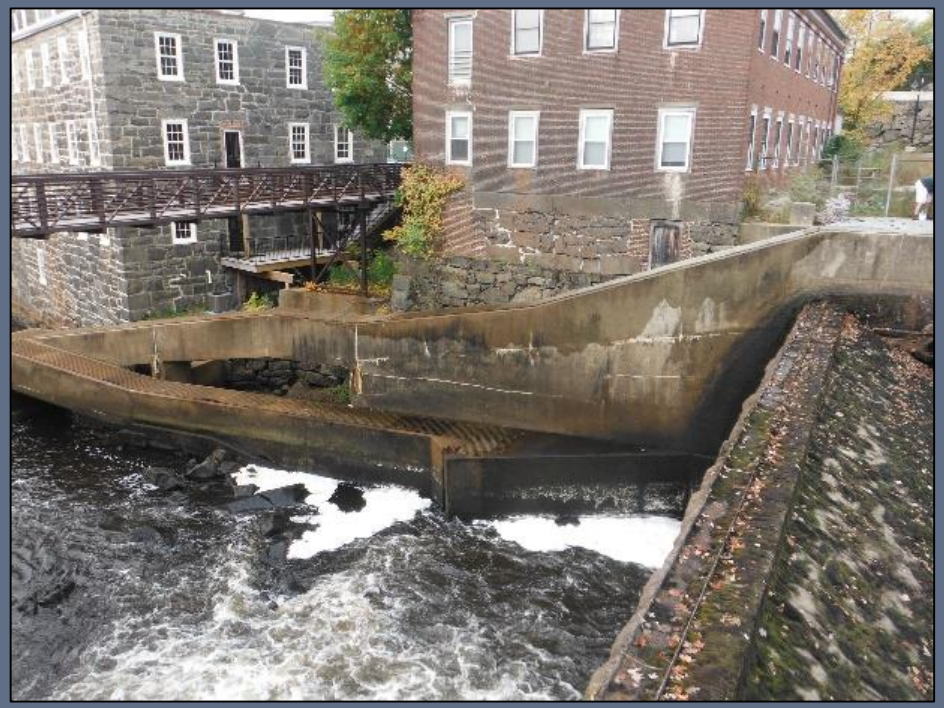
Sediment Thickness Probing

- Sediment thickness probing conducted along 11 transects: 10 in Lamprey, 1 in Piscassic
- Conducted at locations where sediment may mobilize under dam-out conditions
- Backwater/bay areas less likely to mobilize sediment due to dewatering; no probing there
- Increasing sediment volume and decreasing particle size moving upstream, until T9/T10
- Upstream bedrock controls will prevent headcut beyond current impoundment extents



Environmental Information - Fish Passage

- Dam equipped with denil-style fish ladder; owned/operated by NHFGD.
- Since 1972 , NHFGD estimates ~1.4 million river herring have passed through the ladder.
- Other native species use the fishway including Atlantic salmon, sea lamprey and American eel.



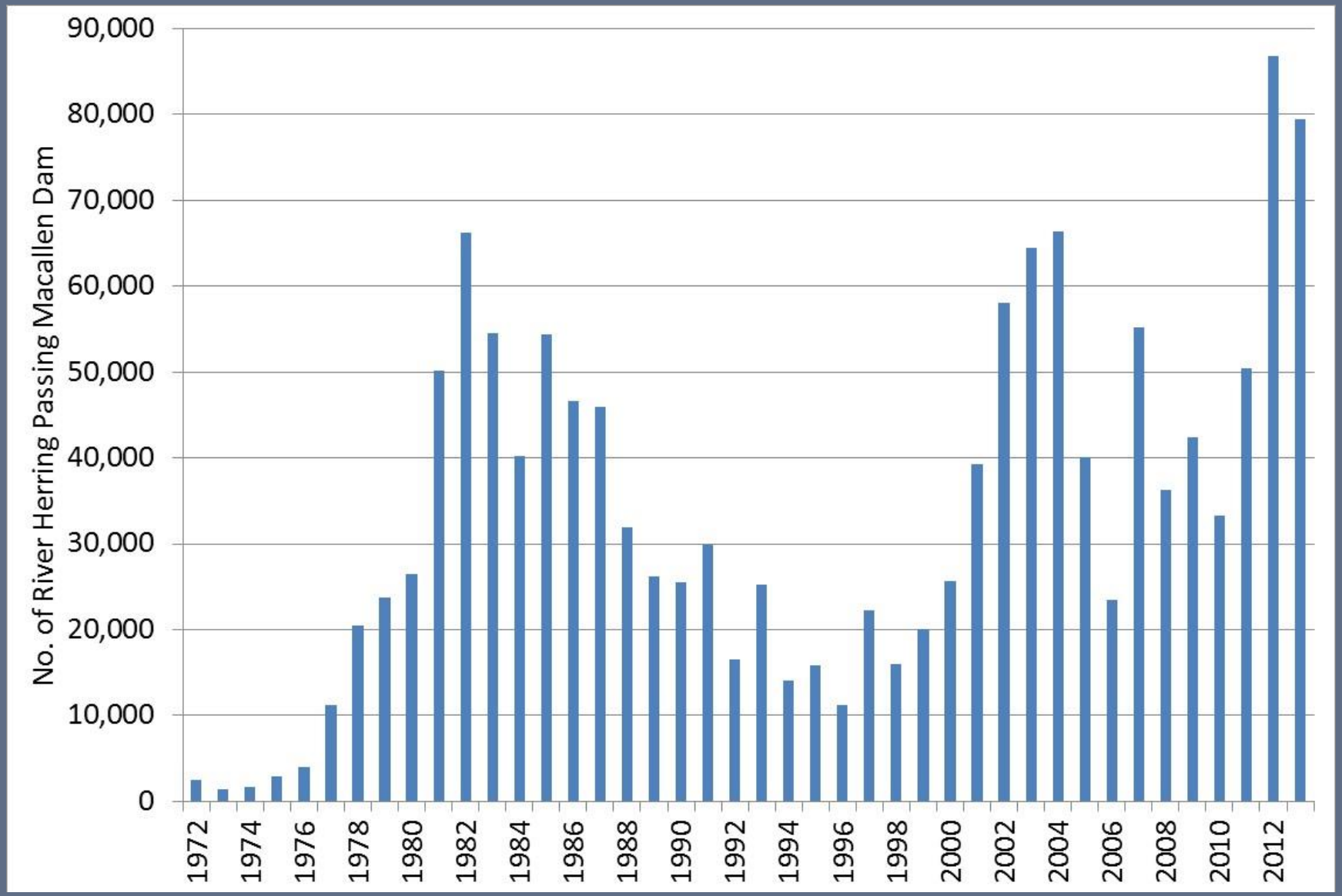
Environmental Information - Fish Passage

- Ladder is 3-feet wide, which is appropriate for river herring, but some species like American Shad may prefer a wider structure.
- Young-of-the-year American elvers (eel) cannot effectively navigate the ladder due to high velocities.
- Seasonal operation of the ladder prevents resident species from having year-round access to upstream waters.
- Lowering the dam spillway crest would impact the fishway.

http://www.nefsc.noaa.gov/rcb/photogallery/anadromous.html

Source: New Hampshire Fish and Game Department

Environmental Information - Fish Passage



Environmental Information- Water Quality & Rare, Threatened and Endangered Species

- Downstream of Macallen Dam has aquatic life impairments due to pesticides, metals and PAHs, & fish consumption impairments due to PCBs.
- Upstream of Macallen Dam has aquatic life impairments due to pH in the mainstem Lamprey, while the Piscassic impounded reach has impaired dissolved oxygen, dissolved oxygen saturation and pH.
- Several federal and state rare, threatened or endangered species (RTE), or species of concern, are located in Newmarket or Durham.
- If feasibility study is advanced, consultation with NH Natural Heritage Bureau, USFWS and NMFS is needed to determine if dam removal could impact RTE species.

USFWS = United States Fish and Wildlife Service

NMFS = National Marine Fisheries Service

Infrastructure Information – HTA

- HTA inspected the Veterans bridge, retaining walls and the building foundations adjacent to the dam (Durham Book Exchange and former Selectwood buildings).
- Limited to a visual inspection only during Oct 2013 drawdown – no structural calculations or testing was completed.
- Veterans Bridge and retaining wall appears to have a low scour risk and no further investigation is recommended.

Infrastructure Information – HTA

- No further investigation necessary at Durham Book Exchange building as long as the Town places sandbags under high flows.
- Further scour evaluation at the Selectwood building is recommended, as the foundation has areas of concern.
- The two railroad bridges were not investigated; any further work should evaluate potential impacts to those crossings.

Infrastructure Information – Well Survey

- Town of Newmarket provides public water/sewer.
- Durham residents near impoundment rely on private drinking water wells.
- Survey sent to Durham residents around impoundment asking the type of well, installation date, depth to water and well depth
- 50 letters sent, 14 owners responded (28% return rate).
- 12 bedrock wells, two (2) were uncertain of well type.
  - No “dug” or unconfined well reported.
- Depth to water between 6 and ~ 310 feet; total depth ranged from 190-600 feet.
- Remote possibility that long-term changes in river levels may impact deep wells’ static water levels.
- Unclear whether static water level changes, if the occur, may ultimately reduce a well’s yield below an acceptable level.

Hydrologic Analysis

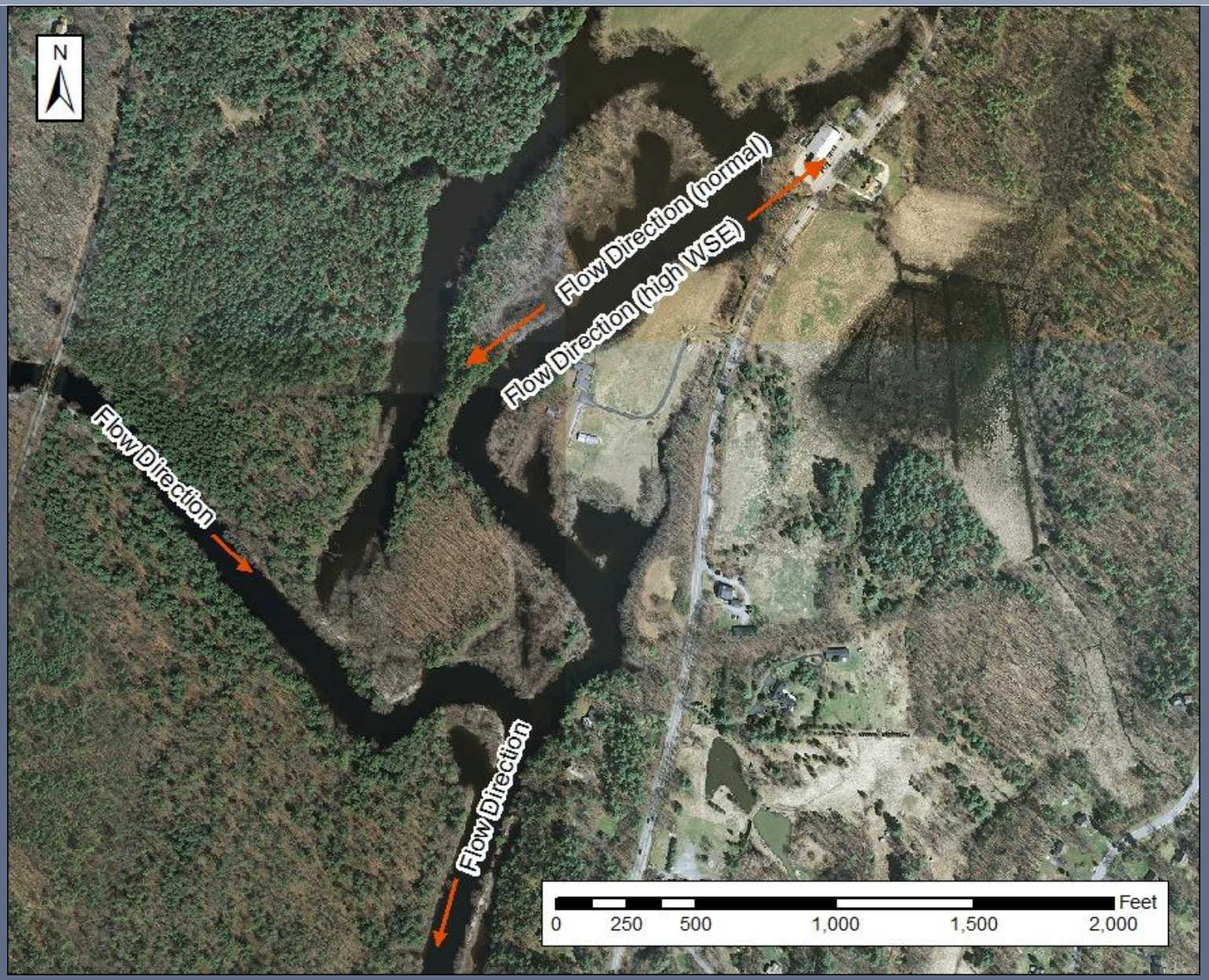
- Monthly flows were drainage-area prorated from the Packers Falls USGS gage (185 mi^2 vs 212 mi^2).
- Mean annual flow at Macallen Dam is 337 cfs.
- 90% exceedance flow for September is 10 cfs.
- Mean fish migration flow (4/15-6/10) is 472 cfs.

Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Min	28	36	45	102	51	12	2	2	2	3	10	12	2
Max	3224	5210	7266	8572	9230	5003	3606	2492	3344	7346	2181	2696	9230
Median	242	251	539	616	322	138	63	43	36	86	219	290	197
Mean	331	360	725	809	427	236	112	86	82	163	316	395	337

Hydrologic Analysis – Flood Flows

- Flood flows determined three ways:
  - FEMA Flood Insurance Studies (FIS).
  - Bulletin 17B statistical analysis of Packers Falls USGS gage data.
  - Watershed rainfall-runoff modeling.
- Dam safety applications use rainfall-runoff modeling.
- Wright Pierce study established the 100-year flood flow at the Macallen Dam as 10,260 cfs.
  - This may change depending on 'flow split' diversion changes.
  - Lowering/removing the dam reduces the diversion amount, such that more flow passes over Macallen Dam.
- Dam must pass the 100-yr flow with 1 foot of freeboard, or otherwise meet the provisions of Env-Wr 303.12.

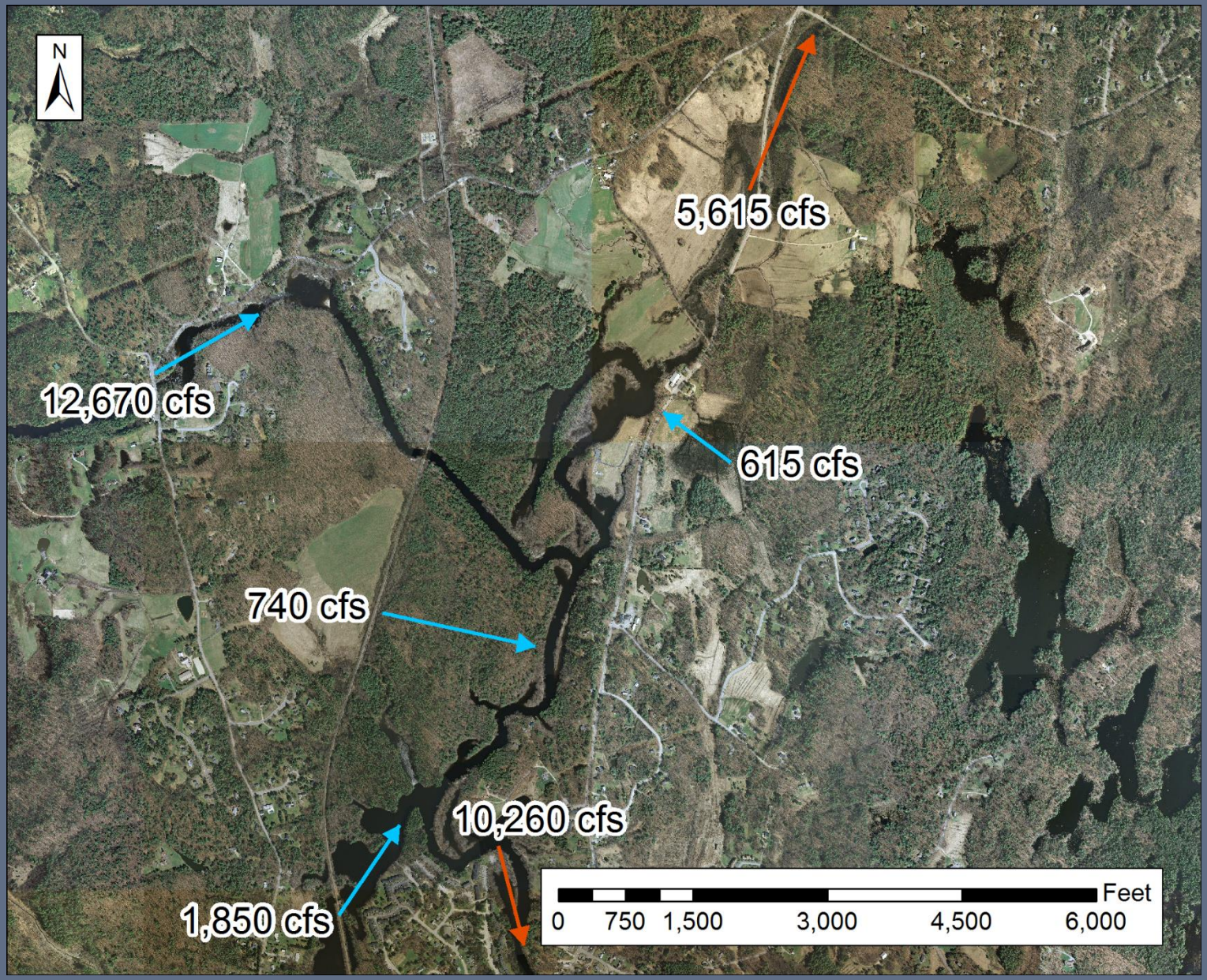
Hydrologic Analysis – Flood Flows (Flow Split)



Hydrologic Analysis – Flood Flows

- Wright-Pierce 100-year flood flow has 15,875 cfs entering the Macallen Dam impoundment and 'flow split' area:
  - Mainstem Lamprey River: 12,670 cfs.
  - Piscassic River: 1,850 cfs.
  - Tributaries: 1,350 cfs.
- 10,260 cfs passes to Macallen Dam.
- 5,615 cfs passes to the Oyster River watershed.

Hydrologic Analysis – 100-year Flood Flow (Dam-In)

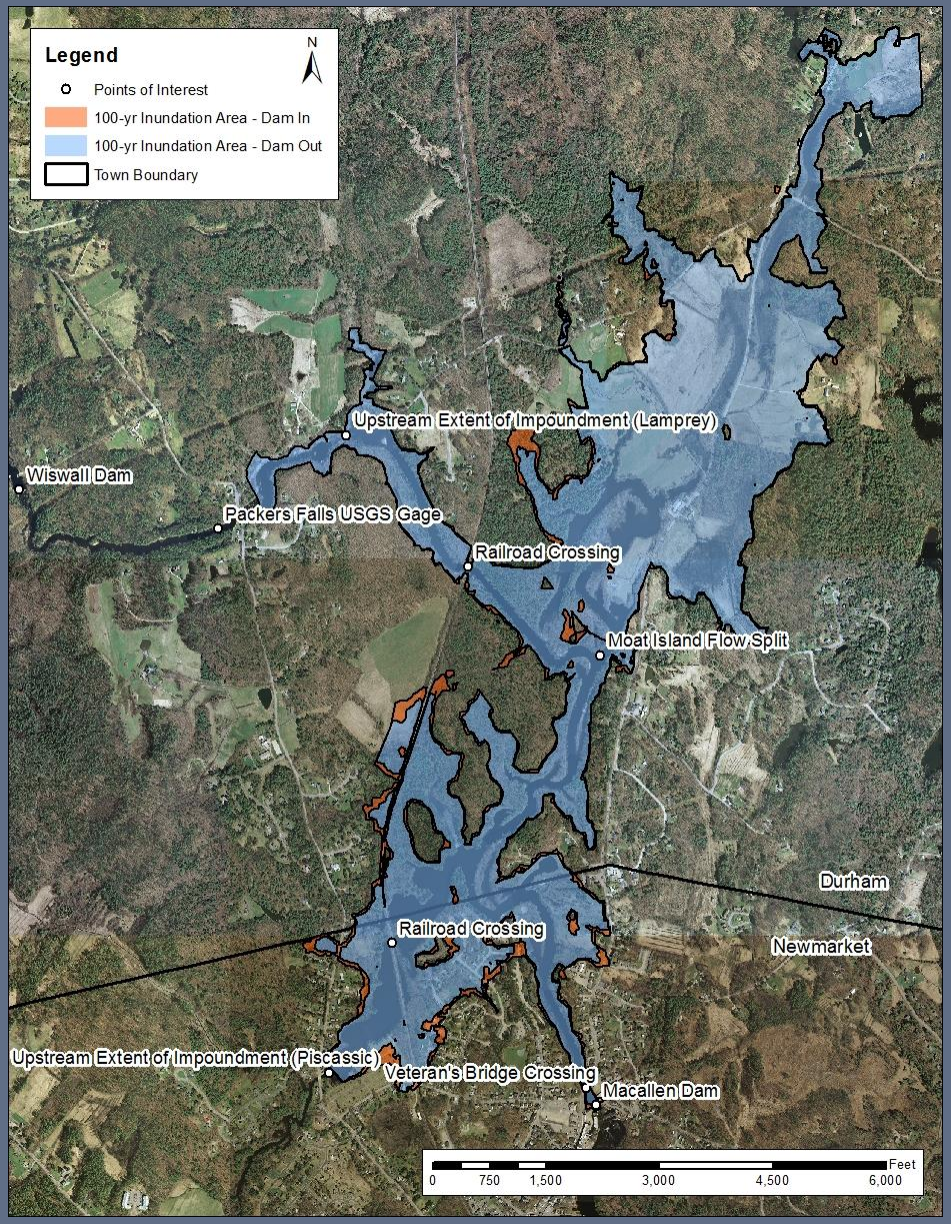


Hydraulic Modeling Results

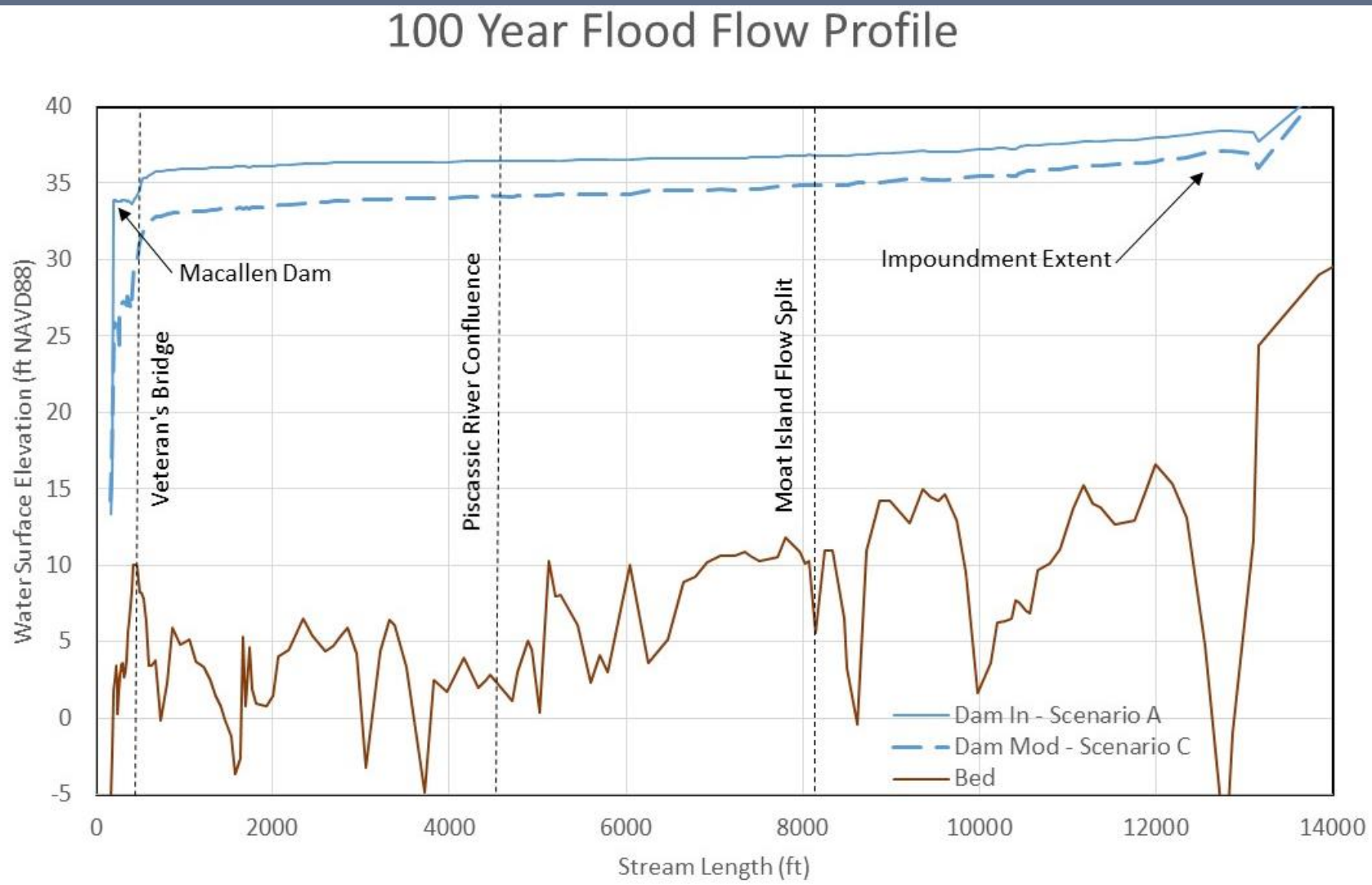
- A hydraulic model was developed to predict water surface elevations, depths and velocities in the Macallen Dam impoundment (Lamprey and Piscassic Rivers) under a range of flows for dam-in and dam-out conditions.
- Includes channel restrictions, Veterans Bridge, Macallen Dam, flow split, etc.
- Calibrated to several historic flow events.
- Includes gate flow (if applicable), spillway flow, overtopping flow (minimal due to surrounding buildings).
- 100-year flood flow must be run with gates closed.

Hydraulic Modeling – 100-yr Flood Flow

- Removing Macallen Dam moderately reduces WSEs throughout reach.
  - 16.1 feet at dam
  - 1.4 to 3.5 foot reduction upstream of Veterans Bridge
  - 2 feet at Moat Island
  - 1.4 feet at head of impoundment
- Some reduction in inundated area, no major reductions.

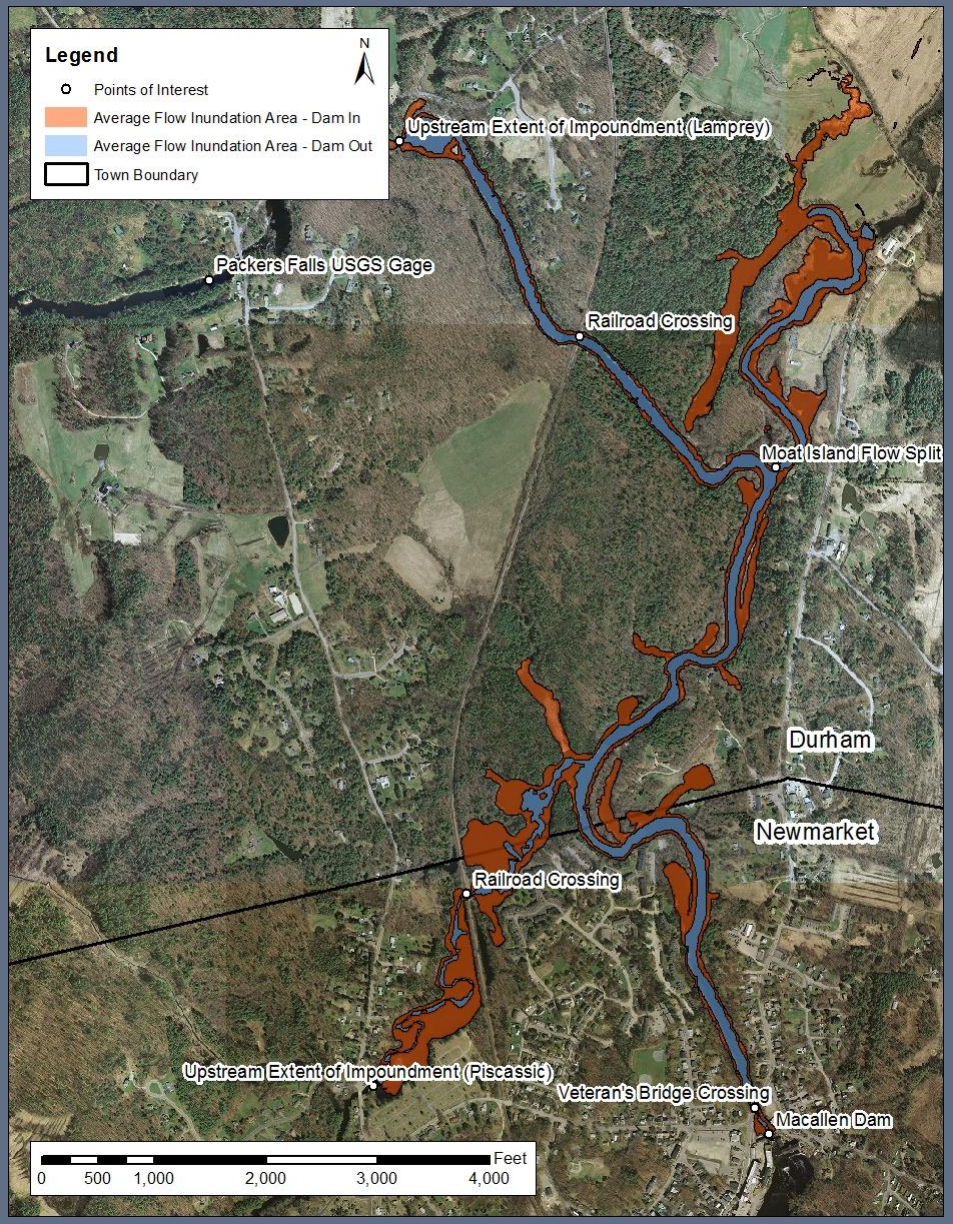


Hydraulic Modeling Results

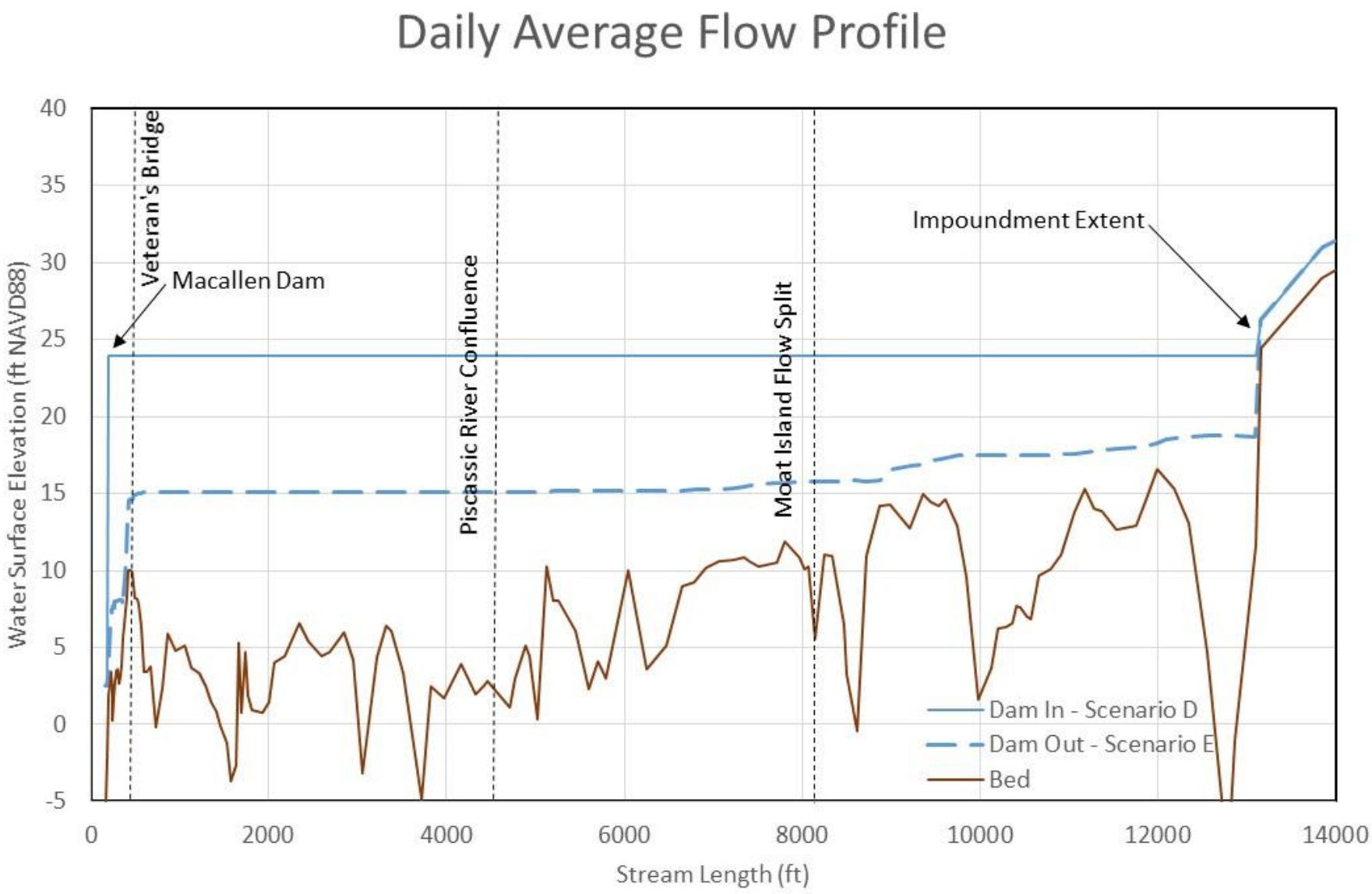


Hydraulic Modeling Results– Daily Average Flow

- WSE reduction throughout reach.
  - 20.4 feet at dam
  - 5 to 9 foot reduction upstream of Veterans Bridge
  - 8.1 feet at Moat Island
  - 5.3 feet at head of impoundment
- Some backwater/bay areas dewatered.
- Major width reduction in Piscassic.
- River width significantly reduced along Moat Island area.

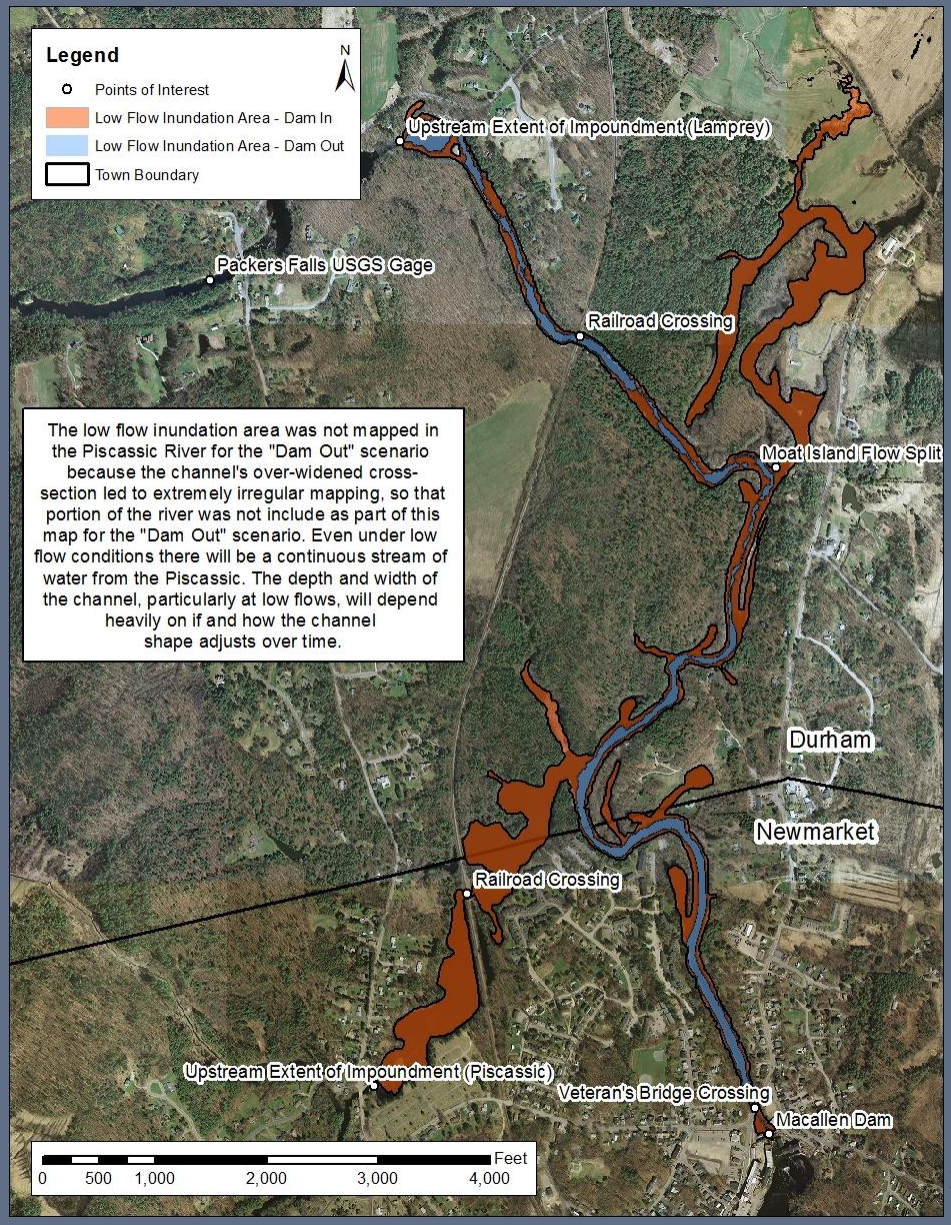


Hydraulic Modeling Results

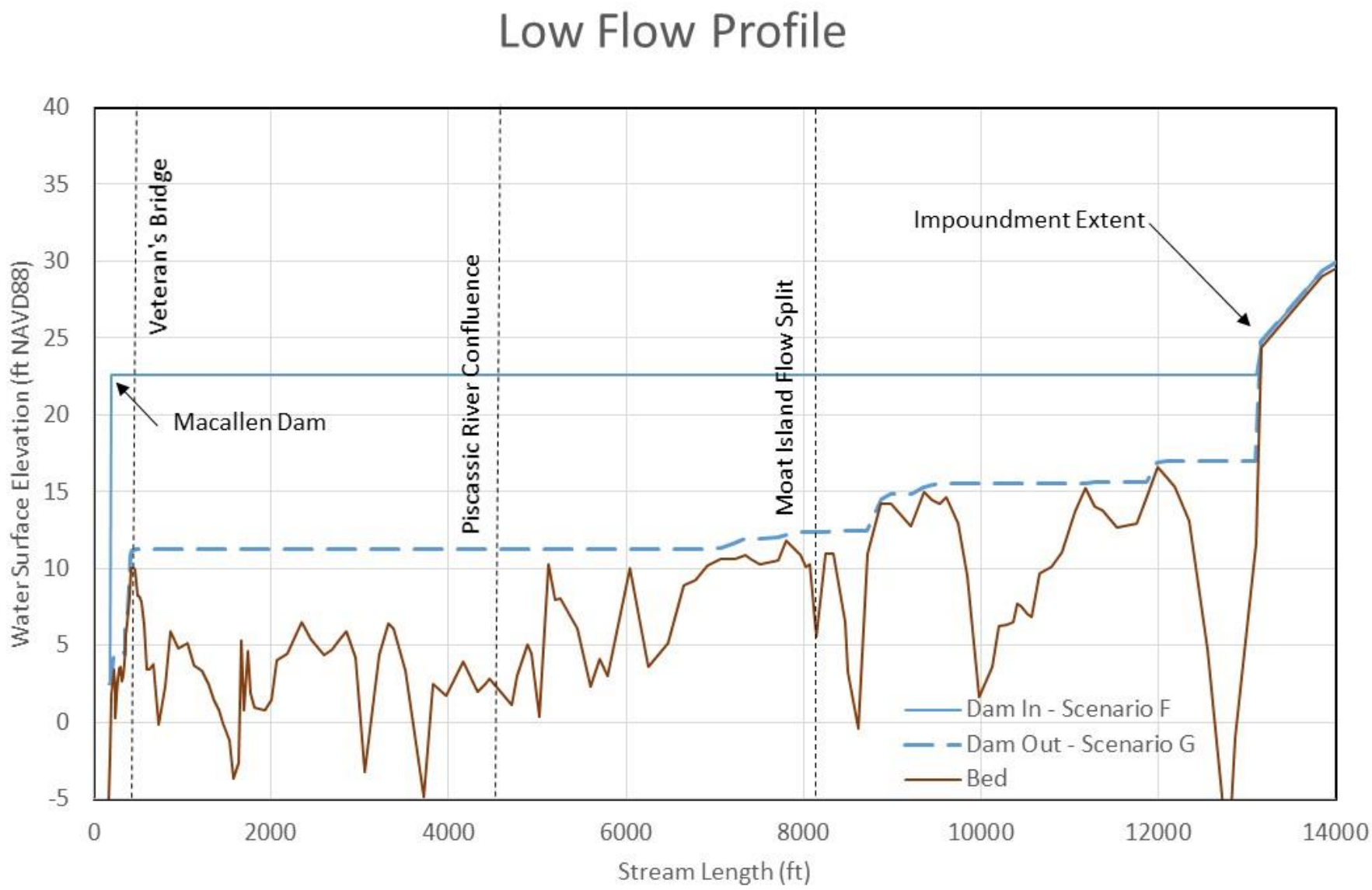


Hydraulic Modeling Results– Low Flow

- WSE reduction throughout reach.
  - 20.1 feet at dam
  - 5 to 10 foot reduction upstream of Veterans Bridge
  - 10.2 feet at Moat Island
  - 5.6 feet at head of impoundment
- Most backwater/bay areas fully dewatered, including Moat Island area.
- Major width reduction in Piscassic River reach.



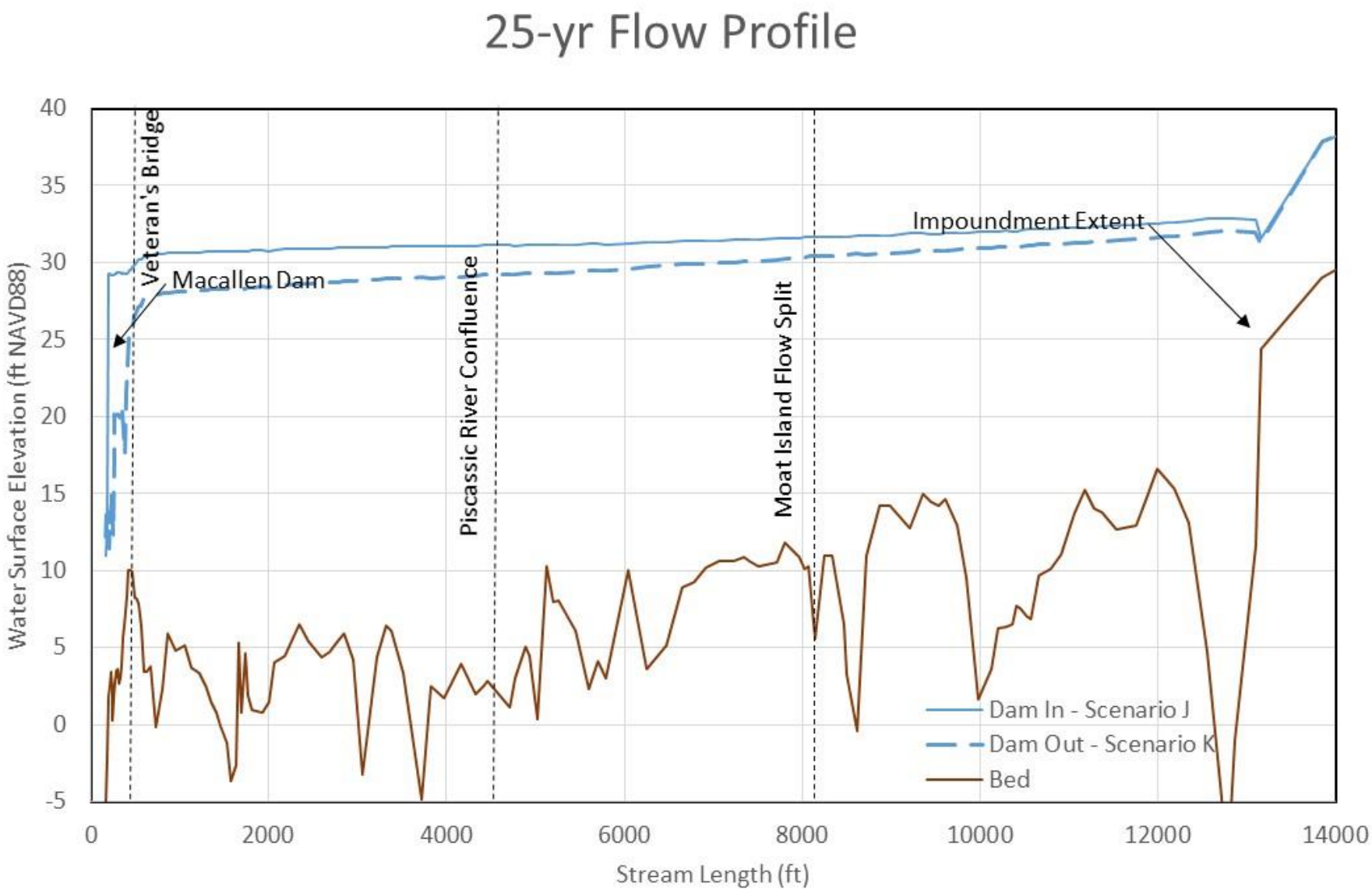
Hydraulic Modeling Results



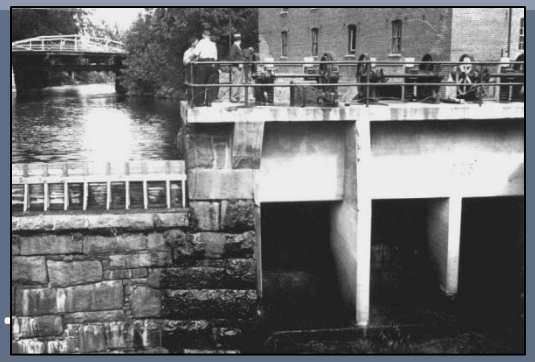
Hydraulic Modeling Results– 25-yr Flood

- The 25-year flood flow at Macallen Dam was estimated using Bulletin 17B and a drainage-area proration
- Chosen to represent a more frequent event than the 100-year event
- Dam removal nearly eliminated flow diversion to Oyster River (from 1,034 cfs to 23 cfs) and reduced flood WSEs by 1-3 feet throughout the study area
  - Dam-In: 6,274 cfs at Macallen Dam
  - Dam-Out: 7,320 cfs at Macallen Dam
- Even greater flood WSE reductions can be expected for smaller, more frequent storms (e.g., 5-yr, 10-yr event)

Hydraulic Modeling Results



Cultural Resources

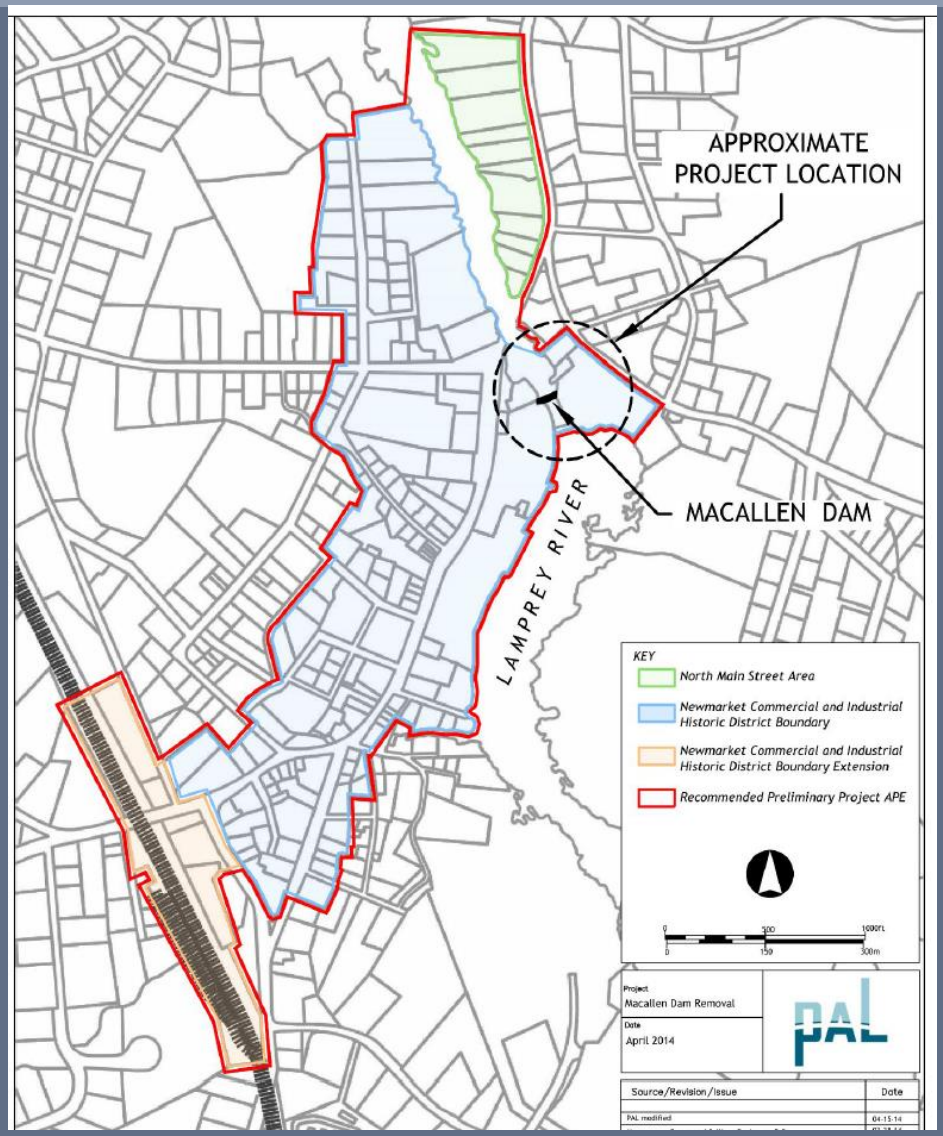


Background

- Any project involving federal funding or requiring a federal permit is required to go through Section 106 of the National Historic Preservation Act (NHPA).
- Section 106 requires federal agencies take into account the effects of their undertaking (dam repair/dam removal) on historic properties.
- All federal agencies are responsible for addressing Section 106; for this feasibility study the lead federal agency (LFA) is NOAA. As LFA, NOAA must coordinate with the State Historic Preservation Office.
- Whether the dam is removed or repaired the Town must address the Section 106 process as federal permits will be required.
- Public Archaeological Laboratory (PAL) conducted a pedestrian survey and recommended an Area of Potential Effect (APE).
- PAL completed NH Division of Historic Resources (NHDHR) Request for Project Review Form. Sent to NHDHR on June 9, 2014.

Cultural Resources – PAL Findings

- Macallen Dam is not in the NHDHR architectural inventory files.
- The dam is located within, but not listed as a contributing resource to the Newmarket Commercial and Industrial Historic District which is on the National Register of Historic Places.
- 24 archaeological sites are within a 5 km radius of the study area. None of the recorded sites are located in the study area.



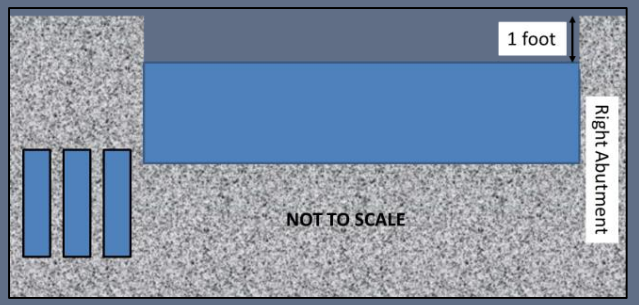
Other Potential Alternatives

- Existing Conditions
  - Dam can pass 2,627 cfs with 1 ft of freeboard or 26% of the 100-yr flood (2,637/10,259).

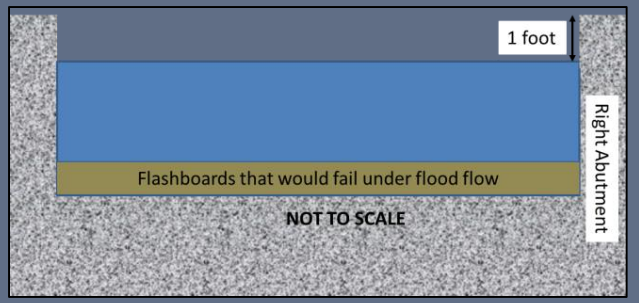
- Remove gates (not realistic alternative)
  - Dam can pass 4,286 cfs with 1 ft of freeboard or 42% of the 100-yr flood.
  - Assumes 6.3-ft flashboards are needed- unrealistically high flashboards.
  - Loss of flashboards would render fish passage ladder inoperable.
  - Loss of flashboards would result in more water flowing toward dam.

Other Potential Alternatives

- Remove gates, raise right abutment
  - Dam can pass 5,926 cfs with 1 ft of freeboard or 58% of the 100 yr flood.



- Remove gates, extend spillway, raise right abutment, lower spillway crest 3' and install 3' high flashboards
  - Dam can pass 9,139 cfs with 1 ft of freeboard or 89% of the 100-yr flood.
  - NHDES typically requires a low-level outlet.
  - Loss of flashboards would render fish passage ladder inoperable.
  - Loss of flashboards would result in more water flowing toward dam.
  - Removing 3' of dam could impact its stability (gravity dam).



Other Potential Alternatives

- Buy and remove Durham Book Exchange Building and raise the right abutment. Per NHDES Sep 2010 letter the main concern with dam failure is the habitation of this building.

- Various combinations of widening the spillway, partially or fully removing the gates and adding flashboards.
  - Limited ability to widen spillway due to infrastructure.
  - NHDES typically requires a low-level outlet.
  - Loss of flashboards would render fish passage ladder inoperable.
  - Loss of flashboards would result in more water flowing toward dam.
  - Lowering the spillway crest removes weight from dam- could impact stability.

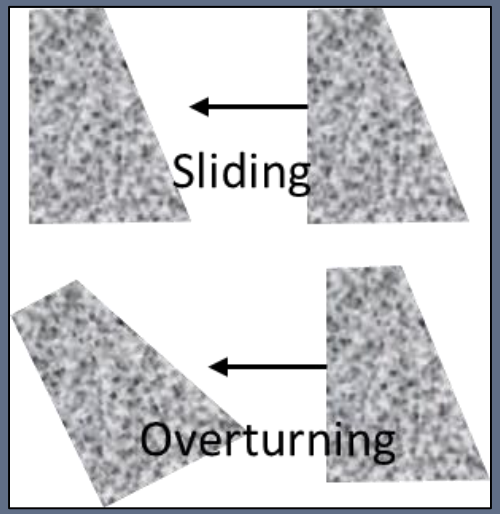
- Extremely Remote Alternative- Construct new dam between Veterans Bridge and Macallen Dam as the channel width is much wider.

Other Potential Alternatives

- Per Env-Wr 303.12 (Meeting Discharge Capacity Requirements) of the NHDES Dam Safety Regulation it states for Env-Wr 303.12(c)(2):

  "Submit a stability analysis to the department showing that the dam is safe against sliding, overturning, or erosion by overtopping, as applicable, during the specified flood, using the methods outlined in …….."

- If Town opts to conduct stability analysis, it is recommended they consult with NHDES Dam Bureau prior to conducting the evaluation to ensure Dam Bureau agrees with the study methods and assumptions.
- Recommend study be conducted incrementally to save on costs.
- No guarantee analysis will show dam is stable.



Budgetary Estimates

Dam Repair Alternatives (Source: Wright Pierce)

Item	Budgetary Cost
Town expenditures to develop cost estimates for maintaining the dam (Wright Pierce Evaluations)	Unknown
Dam Repairs, Phase II	$315,500 (2013 dollars)
Dam Repairs and Modification, Phase I work and Resolution of Inadequate Spillway Capacity	$1,100,000 to $3,000,000 (2013 dollars)
Required Fish Ladder Improvements	Unknown
TOTAL	$1,415,500 to $3,315,500 (2013 dollars)

Dam Removal Alternative

Items	Budgetary Cost
Partial Feasibility Study	$81,700[1] (2014 dollars)
Completion to Full Feasibility Study	$171,000[2] (2014 dollars)
Budget Estimate for Dam Removal	$743,000[2] (2014 dollars)
TOTAL	$995,700 (2014 dollars)

[1]Includes $40,000 from a grant.

[2]Grants could be pursued to lower the cost to the Town.

NOTE: Budget estimate for Dam Removal should be considered a starting point.

Remaining Study Schedule

Remaining Study Schedule

Date	Task
June 23	Public Meeting to discuss Draft Report findings.
July 7	Due Date for *written comments on Draft Report. All written comments will be added as an Appendix to the Final Report.
July 21	Final Report submitted to Town - Town to post on website.
Town Council to evaluate next steps.	

***Written Comments should be sent to:**

Gary Lemay, PE
Gomez and Sullivan Engineers, P.C.
41 Liberty Hill Road
P.O. Box 2179
Henniker, NH 03242


QUESTIONS?